## Supplementary Methods

The stimuli were displayed on a high-resolution color monitor. Background luminance was set to the middle of the monitor's range (16 cd/$m^2$). All Gabor patches subtended 2º of visual angle (full width at 1/e), on the basis of a fixed 114 cm viewing distance. Prior to testing, stimulus contrast was adjusted for each observer so that the average performance across all response lags was at 80-85% correct level. The stimulus contrast for the suprathreshold stimuli ranged from 8 to 12% (across observers) and was kept constant at 4 and 9º eccentricity to ensure comparable overall discriminability[1].

Set size (1,8) and response tone (40, 94, 200, 350, 600, 1000 & 2000 ms) were randomly presented within each block. The 3 conditions (4º, 9º and 9º magnified) were presented in a counterbalanced order. Each of the 3 observers performed a total of 20,250 orientation discrimination trials over 18, 50-min sessions.

Cortical magnification

A cortical magnification factor (M) has been derived by measuring visual contrast sensitivity of sinusoidal gratings at different areas of the visual field using both detection and discrimination tasks[2,3]. Linear cortical magnification (M) describes the distance along visual cortex corresponding to 1º visual eccentricity and is expressed in mm of cortex per degree of visual angle. By scaling the stimulus dimensions appropriately, one can equate the amount of cortex activated, regardless of retinal eccentricity, and achieve similar spatial and temporal contrast sensitivity functions. Magnified stimuli were designed to evoke a cortical representation with a constant stimulus size, spatial frequency, and orientation difference between the target and distracters across eccentricities. Size magnification was obtained by averaging the values given by the following equations:

$$M_{\text{superior visual field}} = (1+0.42E+0.00012\,E^3)^{-1}M_0$$

$$M_{\text{inferior visual field}} = (1+0.42E+0.000055\,E^3)^{-1}M_0$$

where E is degree of retinal eccentricity, $M_0$ is the magnification value (7.99 mm/º) for the most central fovea. The enlargement was based on the standard stimulus size (2º) presented at central vision, resulting in 3.6º. At 2 cpd, the resulting increment in sensitivity is identical for vertical and oblique gratings[4].

To achieve frequency scaling, the cycles/grating were held constant, and the items' spatial frequency was lowered based on 2-cpd at central vision, resulting in 1.1-cpd.

The orientation was magnified according to the orientation threshold function[3]:

$$TH = 0.257^\circ\,[1+14.5'L^{-1}(1+E/1.95^\circ)]^2$$

where TH refers to the orientation threshold, $L^{-1}$ is the inverse for the line length in min arc, and E is the eccentricity in degrees of visual angle. Orientation magnification was based on 30º of tilt at central vision, resulting in 37.4º.

Exponential fits

We used a hierarchical model-testing scheme to determine how eccentricity and set size affected the shape of the SAT function: The 3 parameters of the exponential equation were fit to each observer's data and the average data. These models ranged from a null model in which the functions were fit with a single asymptote ($\lambda$), rate ($\beta$), and intercept ($\delta$) to a fully saturated model in which each function was fit with a unique set of parameters. The quality of fit was determined by 3 criteria: 1) The value of an adjusted-$R^2$ statistic[5-9], where the proportion of variance accounted for by a model was adjusted by the number of free parameters. 2) The consistency of parameter estimates across observers. 3) An evaluation of whether any fit left systematic residuals that could be accounted for by additional parameters.

References for Supplementary Methods


1. Banks, M.S., Sekuler, A.B. & Anderson, S.J. *J. Opt. Soc. Am.* **8**, 1775–1787 (1991).
2. Virsu, V & Rovamo J. *Exp Brain Res.* **37**, 475–494 (1979).
3. Makela, P., Whitaker, D. & Rovamo J. *Vision Res.* **33**, 723–730 (1993).
4. Quinn, P.C. & Lehmkuhle, S. *Vision Res.* **23**, 655–658 (1983).
5. Reed, A. *Science* **181**, 574–576 (1973).
6. Wickelgren, W. *Acta Psych.* **41**, 67–85 (1977).
7. McElree, B. & Dosher, B.A. *J. Exp. Psychol. Gen.* **118**, 346–373 (1989).
8. McElree, B. & Carrasco, M. *J. Exp. Psychol. Hum. Percept. Perform.* **25**, 1517–1539 (1999).
9. Carrasco, M. & McElree, B. *Proc. Natl. Acad. Sci. USA* **98**, 5363–5367 (2001).